influenza haemagglutinin) and provides an interesting contrast to the small plant virus structures. Icosahedral viruses attain their spherical shape by 'quasi-equivalent' bonding but, whereas in adenovirus this involves chemically non-identical subunit faces, in the plant viruses different binding occurs through modifications of the same structure.

Overall, I feel that these reviews form a useful collection but the book suffers greatly from poor quality of the paper and, consequently, of the illustrations; only one glossy page is included, showing electron micrographs of fd virions. Surely a series devoted to macromolecules and assemblies deserves better quality reproduction than this? The high price of the volume puts it well out of reach of the individual purchaser (who will pay almost £8 per review?) but, regrettably, I cannot recommend the purchase of such a poorly illustrated book as this, even to specialist librarians.

B.W.J. Mahy

Structural and Resonance Techniques in Biological Research

Edited by D.L. Rousseau

Academic Press; London, 1984

476 pages. £52.00, $69.00

Biologists in general and biochemists in particular have always been ready to adopt and adapt the techniques of physics and chemistry for use in biological systems. The biochemist is now faced with a sometimes bewildering range of physical methods, from spectrophotometry to EXAFS, many of which have been greatly increased in sensitivity and sophistication to make them useful in biochemistry. To make the best use of these powerful methods, it is necessary to have at least a modest degree of understanding of their physical bases, and the stated aim of this book, in which it is largely successful, is to meet this need. The techniques covered in this volume are nuclear magnetic resonance (Brown and Ugurbil), electron spin resonance (Kosman), Mossbauer spectroscopy (Dickson and Johnson), X-ray absorption spectroscopy (Scott), macromolecular X-ray crystallography (Moffat), and X-ray small-angle scattering and diffraction (Stamatoff); a companion volume deals with optical techniques.

With the exception of the chapter on X-ray crystallography, each article consists of an outline of the physical principles of the method, an indication of the experimental arrangement and limitations, and a discussion of a variable number of specific biological applications. The crystallography chapter differs in that the applications are obviously well-known. Dr Moffat instead provides a very clear step by step description of the successive stages of a crystallographic investigation, from crystallisation through phase determination to calculation and refinement of the electron density map.

The exposition of the underlying physics in each chapter is generally clear. Starting with high-school physics and a familiarity with vector notation, the assiduous reader should certainly come away able to judge the usefulness of the various techniques for his or her work, and to understand papers in which they are used. In terms of the description of applications, the chapter on ESR is particularly full and detailed, while those on NMR and small-angle scattering provide a more illustrative selection of examples and would serve best as useful introductions to more specialist reviews or books. The bibliographies are generally helpful, though there are few references since 1982; this is not in general serious, but it is a pity that the new two-dimensional NMR experiments receive only a passing mention.

This book provides a valuable introduction to an extremely important group of physical methods and can be recommended to those requiring more

detailed information than is to be found in general texts on physical biochemistry. While it is perhaps too expensive for widespread personal purchase, it certainly deserves a place in any biochemical library, both for teaching and research purposes.

G.C.K. Roberts

Cell Ageing and Cell Death

Society of Experimental Biology Seminar Series 25

Edited by I. Davies and D.C. Sigee

Cambridge University Press; Cambridge, 1984

362 pages. £22.50

This volume deals with an important topic: the relationship between cell death during ageing and cell death in a variety of other biological situations, in both plants and animals. Unfortunately, as is often the case with published proceedings of conferences, the volume lacks cohesion. Instead of providing information and critical discussion relevant to the central theme, it simply lumps together diverse phenomena under one title, for example, the ageing of cultured human cells, cell death in plants invaded by pathogens, in the differentiation of xylem or in leaf senescence, and programmed cell death in chick limb development. The Editors try and pull the many loose ends together in a short concluding section, but they are not successful in this. Franks' even briefer Introduction makes several important points, but what is really needed is a unifying introductory commentary which clearly explains the important similarities and the differences, not only between cell ageing and cell death, but also between the various biological situations which are discussed.

Most workers would agree that the many outward manifestations of the ageing process are due either to the failure of cells to maintain normal functions, or to cell death. However, it is far from clear whether cell death in ageing is related to or is totally different from the programmed cell death that occurs during development and differentiation. Some authors, for example Lockshin and Zakeri-Milovanic, simply assume the mechanism of cell death in all situations is much the same, which is surely a very extreme view. The term apoptosis is generally used for programmed cell death, and Bowen in the longest contribution reviews the variety of changes seen in animal tissues. However, to my knowledge there is no good evidence that apoptosis is an important component of natural ageing.

Many of the contributions would have been greatly improved if they had made clearer the severe limitations of current knowledge; there is a tendency to use long words and references as a cloak for ignorance. Much of what is known about programmed cell death is descriptive, with histology still providing the most information. The beginnings of biochemical approaches have been made, but there are almost no molecular studies of any standing. Cell ageing usually deals with populations and is more concerned with the failure of cell proliferation; again, in spite of innumerable studies, the underlying mechanism remains obscure.

It is a pity that other authors could not have taken Micklem's contribution on the haematopoietic system as a model, since he clearly reviews the experiments which have so far been done, presents the alternative interpretations which can be offered, and draws the proper conclusion that we are still in a state of ignorance about the significance of cell ageing in this system. The well documented article on cell death during limb